

The AMSAT[®] Journal

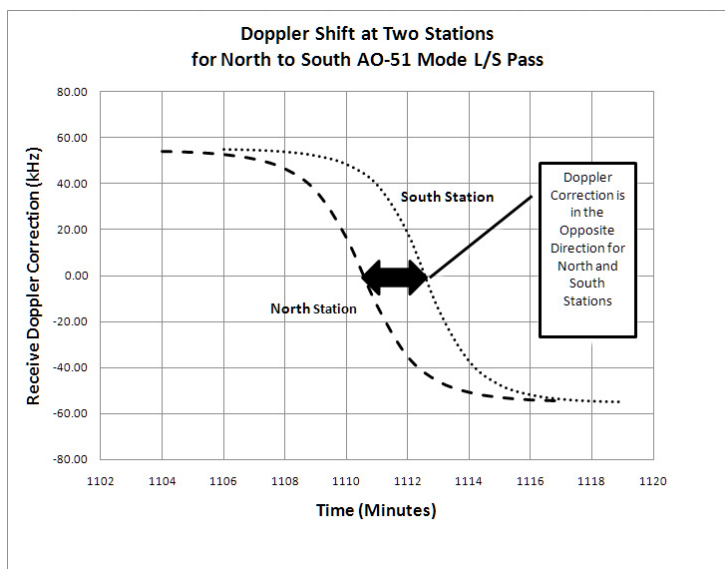


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Volume 33, Number 4

July/August 2010



Got Tuning?



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A codicil in your will, naming The Radio Amateur Satellite Corporation as a beneficiary will help insure the continuance of the Amateur Radio Satellite program.

Call the AMSAT-NA office at 301-589-6062 for questions on any or all of these ways you can help build new and exciting satellites.

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AMSAT Announcements

AMSAT News Service Bulletin 206.06
From AMSAT HQ SILVER SPRING, MD.
July 25, 2010

To All RADIO AMATEURS

BID: \$ANS-206.06

SA AMSAT reports on their Web page <http://www.amsatsa.org.za/> that operations are slowly being resumed on SO-67. The ground control station will observe the amateur payload to ensure the satellite remains stable and then gradually add more operating time.

SA AMSAT requested, "Once the green light is given, requests for operation over your area should be sent to saamsat@intekom.co.za by Mondays for possible inclusion in the schedule published on Thursday night/Friday morning covering the following week. It may not always be possible to accede to every request. The weekly schedule will be published on the SA AMSAT Web page.

With recent changes in software please note the recommended operating procedure described at: <http://www.amsatsa.org.za/>

[ANS thanks SA AMSAT for the above information] 🌐

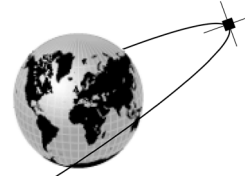
AMSAT's Mission

AMSAT is a non-profit volunteer organization which designs, builds and operates experimental satellites and promotes space education. We work in partnership with government, industry, educational institutions and fellow Amateur Radio societies. We encourage technical and scientific innovation, and promote the training and development of skilled satellite and ground system designers and operators.

AMSAT's Vision

Our Vision is to deploy satellite systems with the goal of providing wide-area and continuous coverage. AMSAT will continue active participation in human space missions and support a stream of LEO satellites developed in cooperation with the educational community and other amateur satellite groups.





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Summertime is sometimes seen as a cooling off period for organizations as volunteers focus on family vacations and recharge their batteries in preparation for a busy fall and new academic year. Hams typically focus on activities outside of Amateur Radio, attracted by the great outdoor weather and other diversions.

While this observation may be true during most years, this is certainly not the case for AMSAT in 2010. Work continues on a number of fronts and I'd like to provide an update to the membership on recent events.

ARISSat-1

Since the last Apogee View column, a number of events have taken place. Some of these were highlighted in the Mid-Year Report that was sent out by the BoD and included in the envelope that was mailed in mid-July along with the ballot. Since that letter was written, there have been further developments:

- a. AMSAT has been verbally notified by RSC-Energia that ARISSat-1 has officially been manifested on Progress Launch 41P, which is currently expected to launch in late January 2011 to the International Space Station. The manifesting of ARISSat-1 in turn has given RSC-Energia payload integration and safety personnel authorization to focus on some of the issues raised by the NASA Payload Safety Review Panel regarding stowage of ARISSat-1 in the cargo vehicle and provide the AMSAT team with recommendations regarding vibration testing. AMSAT expects to conduct the ARISSat-1 vibration tests at the NASA Wallops Flight Facility within the next month.
- b. The ARISSat-1 flight unit is physically operational and ready for vibration testing. This includes fabrication of a mass simulator for the Kursk Experiment that has been added to the spacecraft so that vibration testing will incorporate the mass effects of the Kursk Experiment that will be added to the spacecraft after it arrives in Russia. Software updates continue to be developed for the Power Supply Unit and the IHU.
- c. RSC-Energia has asked the NASA Johnson Space Center to take the lead on delivery of ARISSat-1 to Russia, in essence shipping the satellite as an
- d. As noted in the mid-year BoD report that was mailed to all AMSAT members, ARISSat-1 was subject to a two-day review by the ISS Payload Safety Review Panel (PSRP) during the last week of June. The outcome of that panel review was that additional Payload Hazard Reports documentation which identifies potentially hazardous items within the satellite and the operational controls to mitigate the hazards, must be submitted prior to ARISSat-1 being authorized for EVA deployment from the ISS. NASA has highly recommended that these open items be closed-out prior to shipment of the satellite to Moscow. An update to the ARISSat-1 Payload Safety Review Package is expected to be completed by NASA Goddard Space Flight Center (including documentation provided by AMSAT) later in August with a reconvening of the PSRP at the NASA Johnson Space Center in September to review the updates.
- e. RSC-Energia has indicated that delivery of ARISSat-1 to Moscow must be completed by the first week in October to complete in time the

continued on page 22 ...



Getting Started on the Amateur Radio Satellites

by Keith Baker, KB1SF/VA3KSF, kb1sf@amsat.org

(This article was previously published as "Working Your First Amateur Radio Satellite: It's Easier Than You Think" in Monitoring Times, Brassstown, NC 28902)

One of the great features of Amateur Radio is that it is really several hobbies rolled into one. If you become bored with one aspect of the hobby, there is always something new and different to try. For the last 40 years or so using the fleet of Amateur Radio satellites to communicate has always been one of the more interesting aspects of Amateur Radio.

However, if you are new to amateur satellites, or the "birds" as we satellite operators often call them, it's important to establish a general understanding about how to find and track these modern day wonders *before* you make your first attempts at using them. My goal in this short series of articles for *The AMSAT Journal* will be to provide you with a general introduction to the basic concepts of tracking, operation and customs currently in use on the satellites and to give you some practical, hands-on tips on how, you too, can get started in this wonderful aspect of ham radio. For starters, I'm going to be using one of AMSAT's relatively easier-to-operate (one of or so-called "EZ sats") - AO-51- as an example for you to try out your newfound knowledge.

Indeed, for most of us, the thought of using our own radio equipment to hear or talk through a satellite conjures up a sense of mystery and awe. At the same time, it creates a certain amount of fear ... fear of doing something wrong, or of not ever being successful no matter how hard we try. In years past, when only one or two amateur satellites were in orbit, hams had to really work hard to even hear one of the OSCARS (Orbiting Satellites Carrying Amateur Radio) as they whizzed overhead.

As of this writing, there are some 20 or so active ones up there, and that's not even counting the crew of the International Space Station (ISS) who use the Amateur Radio equipment installed aboard that permanent orbiting laboratory. What's even more exciting is that there are several other Amateur Radio satellites currently on the drawing boards or awaiting launch. So, it's safe to say your chances of at least hearing one of them (or, if you have at least a Technician Class ticket, actually communicating through one with your current equipment) is far better now than at any time in the recent past.

Tracking the Birds

To listen for, or communicate through, an Amateur Radio satellite you first have to find out when it will be within range of your

station. Fortunately, most of us now have a computer in our ham shacks and access to the Internet so tracking satellites has become much easier than it used to be.

Today, several satellite-tracking programs are available in shareware or for purchase, as well as in a variety of different computer formats. What's more, a number of Web sites related to amateur satellite operation now have online tracking programs that make rough tracking a snap. But, if you're really serious about satellite tracking, you should also become familiar with how to use sets of orbital data called Keplerian Elements.

Known to veteran satellite operators simply as "Keps", these data are derived from observations of each satellite's orbital motion. (Kepler, you may recall, discovered some interesting things about planetary motion back in the 17th century!)

Today, NORAD, the North American Aerospace Defense Command, keeps track of almost everything in Earth orbit. Periodically, they issue orbital information on non-classified satellites to the National Aeronautics and Space Administration (NASA) for release to the general public. The information is listed by individual catalog number of the satellite and contains numeric data that describes, in a mathematical way, how the satellite is moving around the Earth.

Without getting into the complex details of orbital mechanics (or Kepler's laws!), suffice it to say this data is what your computer software uses to plot the predicted paths of satellites. That is, once you've loaded your location (latitude and longitude), the current time along with the Keplerian element files into your satellite tracking software, the computer then solves the complex orbital math to make a prediction of where a selected satellite should be at the current (or a future) time.

Because they are such a vital ingredient to this part of our hobby (and because they age over time) finding a reliable source for the latest Keplerian Elements for Amateur Radio satellites should be high on your list of things to do as you get started in satellite work. Keps are often listed on many Amateur Radio Internet Web sites. The AMSAT-North America Web site lists the latest Keps in a variety of downloadable formats at: www.amsat.org.



The author uses a Kenwood TH-78A dual-band HT and a lightweight Arrow Antenna to make a contact through AO-51 from the shores of Lake Huron in Michigan. When used with a 5 watt, full-duplex handheld in an open location free of foliage, such as a beach or a field, the antenna provides enough uplink and downlink gain to successfully work the FM birds, even on passes close to the horizon. (KB1OGF Photo)



amsat.org/amsat-new/tools. And, as I said, for the so-called “easy FM birds” like AO-51 and the ISS, the AMSAT Web site even sports an embedded online tracking feature which allows you to simply plug in your latitude and longitude (or your Maidenhead Grid Square) to find out when those satellites of interest to you will next be in range of your location.

Beacons

Probably one of the first things you will learn to do after you find out when a particular satellite will be within range of your station is to listen for the satellite’s beacon. Most satellite beacons consist of one or more transmissions coming from the satellite that will assist you in your search as well as tell you other things about the satellite’s health and the nature of its transponders.

Satellite beacons operate in many modes, from Morse code to a variety of digital formats, and can usually be found on frequencies immediately above and/or below the satellite’s other downlink frequencies. In addition, as most satellite beacons transmit with a fixed amount of output power, they can also serve as a superb reference point for setting up and calibrating your station antennas and other equipment.

Most satellite telemetry signals, which consist primarily of transmissions about the health of the satellite, are also sent to ground controllers by way of the beacon. What’s more, some satellites even provide information regarding their transponder schedules, along with other items of interest to satellite operators, using their beacons. However, in the case of AO-51 and most of our other FM satellites, the single channel downlink is itself, the beacon.



Dubbed “Echo” before launch, the AO-51 satellite sits in the “Space Head Module,” the upper stage of its launch vehicle at the Baikonour Launch Complex in Kazakhstan. (AMSAT Photo)

Transponders

Now that you have a reliable way to know when the satellite is within range of your station and you’re familiar with its beacon, you next have to learn how to use its transponder. A transponder is the circuit that receives your uplink signal and then retransmits what it hears via its downlink transmitter, much like an FM repeater does. However, unlike a terrestrial FM repeater, which has a specific input and output frequency in the same band, most amateur satellite transponders receive and then retransmit what they hear on another frequency (or frequencies) on another amateur band entirely. In short, most amateur satellites act much like cross-band repeaters in the sky.

What’s more, as a satellite is a moving target, signals being passed through it will exhibit a pronounced Doppler shift, just like the changing pitch of a train whistle as it approaches and then passes. During a satellite contact, as the satellite approaches you, both uplink and downlink frequencies will appear higher than those published. As the satellite passes overhead, both the uplink and downlink frequencies will then appear to slowly drop in frequency than those published. And, as if that weren’t confusing enough, this apparent frequency shift will seem to be more pronounced on the higher frequency (shorter wavelength) amateur bands than on the lower ones.

Our example satellite, AO-51, uses what’s called a “bent pipe” transponder. That is, whatever form of radio communication is sent up to the satellite on the uplink is simply “sent through the pipe” back down on the downlink. AO-51 sports a variety of transponders, but the one I will be helping you attempt to use is its FM voice transponder.

Operating Modes

One of the terms you will soon come across in satellite work will be a reference to the mode of a satellite’s transponder. A satellite’s operating mode is nothing more than a shorthand way veteran satellite operators identify the various combinations of uplink and downlink frequencies available for use.

Back in the old days of satellite operating, one or more letters of the alphabet were used to designate satellite transponder modes. For example, if a satellite’s uplink frequency was on 2 meters and its downlink frequency



The author’s wife, Kate Baker, KB1OGF/VA3OGF, makes a contact through the AO-51 satellite on the shores of Lake Huron in Michigan with her Kenwood TH-78A dual band HT. The extended “rubber duck” (MFJ Model 1717 from MFJ Enterprises) antenna and about 5 watts of uplink power provides just enough gain on the uplink and downlink to briefly work the satellite on near overhead passes.

was on 70 cm, the satellite was said to be operating in “Mode J”. An uplink on 70 cm with a downlink on 2 m was called “Mode B”, and so on.

Today, because so many satellites with different uplink and downlink transponder combinations are now in orbit, a somewhat more complex system that includes the first letter of the band in use (VHF, UHF, SHF, etc.) has emerged. As a result, the old “Mode B” has now been renamed “Mode U/V” because the satellite’s uplink transponder receiver is tuned to UHF and its downlink transmitter is set for the VHF bands. Likewise, the old “Mode J” has now been dubbed “Mode V/U” and so on. For this article, the AO-51 transponder we’re interested in is the one for Mode V/U ... or the old Mode J ... with uplinks in the 2 M band and downlinks in the 70 cm band.

Schedules

Most amateur satellites operate on a published schedule that lists when its various transponders will be switched on and off and at what times. As AO-51 has multiple transponders, it’s very important to always check the published schedule for the satellite before you attempt to use it. AO-51’s current operating schedule is always available via the AO-51 Control Team page



Some Popular Amateur Radio FM "Easy Sat" Frequencies			
Satellite Name	Uplink	Downlink	Remarks
AO-51 (Echo)	145.920 MHz 145.880 MHz	435.300 MHz 435.150 MHz	Default FM Voice
AO-27 (Eyesat)	145.850 MHz	436.795 MHz	Daytime Passes
SO-50 (SaudiSat 1-C)	145.850 MHz	436.795 MHz	67.0 Hz CTCSS Tone Required for Access

of the AMSAT Web site at: www.amsat.org/amsat-new/echo/index.php. Click on the "check the schedule" link and look for the "FM Repeater" frequencies. During a typical month, traffic on the transponders might be FM voice, Slow Scan TV (SSTV), low power (QRP) FM operating and/or the digital modes. By looking at the schedule you'll know when to expect the various modes and at what frequencies they'll be operating. Also, look for other activities on the schedule such as College Satellite Night or when AO-51's control operators reverse the spacecraft attitude to favor the southern hemisphere.

Equipment

Contrary to what you might believe, you *don't* need a super powerful FM transceiver and a huge antenna to work the birds. In fact, I (and many other amateur satellite operators) have sometimes met with success using just a simple dual-band hand-held radio and an antenna with just a bit more gain than the ordinary "rubber duck." However, because the UHF downlink output power on these "EZ sats" is usually pretty weak

(often less than 1 watt) you'll have far better success if you can create some signal gain on the downlink.

Several people have "rolled their own" Yagi satellite antennas for AO-51 using nothing more sophisticated than a series of trimmed coat hangers mounted on a block of wood. However, for many years and for most of my own AO-51 contacts, I've been using a commercially made, hand-held antenna from Arrow Antenna of Cheyenne Wyoming, www.arrowantennas.com. Their "Arrow II" Satellite antenna (with models starting at about \$75) is specifically manufactured for hand-held radio satellite work, is very well constructed (from aluminum arrow shafts, hence the name) and is collapsible for easy portable use.

It is also important to remember that AO-51, like most amateur satellites, operates in what's called *true duplex* or *full duplex* mode, meaning that the uplink receivers and downlink transmitters are both operating at the same time. It is helpful (but not absolutely necessary!) for your ground-based equipment to do so as well. By operating your station (or your hand-held) in full duplex mode, you will get immediate feedback that the satellite hears you because you will actually hear your own uplink signal coming back down to you on the downlink.

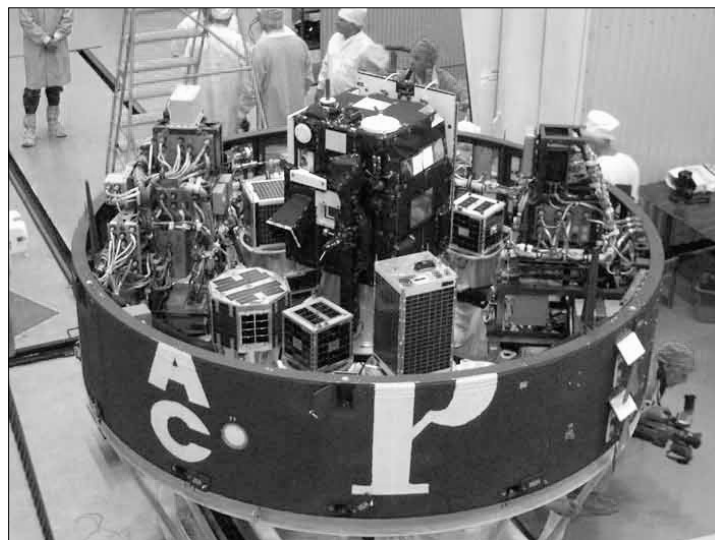
Unfortunately, fewer and fewer commercially manufactured radios these days have the capability to operate in full duplex mode. As of this writing, a short list of those (mostly older) radios compiled by Andrew,

KE5GDB, which do so can be (temporarily) found at <http://bit.ly/bUGJR3>.

However, even if you don't have a full duplex radio, you can still get in on the fun of working these satellites by using two separate radios, or a radio that can transmit on the satellite's uplink and another radio that can receive the downlink. If there is enough gain in your antenna, the latter radio can even be a hand-held or other programmable VHF/UHF scanner of some sort. Many novice satellite ops have also met with some success on AO-51 by simply waiting for a break in the action to transmit "in the blind" on the uplink and then listening for someone answering them on the downlink.

Setting Up Your Radio

Now that you have found out what time of day AO-51 will be in range of your location and you have assembled the equipment and antennas to do so, you are *almost* ready to make your first contact. But, first, you'll need to program your radios so as to take into account the Doppler shift that we discussed



Numerous other satellite passengers dwarf AO-51, shown here sitting in its upper stage carrying structure just prior to launch from the Baikonour Launch Complex in Kazakhstan. AO-51 is the small cube-shaped satellite shown in the lower left of the photo between the octagonal-shaped Italian UniSat-3 and the taller SaudiSat 2. (AMSAT Photo)



Chuck Green, N0ADI, prepares AO-51 for launch at the Baikonour Launch Complex in Kazakhstan. (N0ADI Photo)

earlier. If your radio has programmable memories, it's a good idea to program one or two additional frequencies into the memory bank above and below the published uplink and downlink frequencies. These can be used as the satellite first moves toward you and then away from you as it passes overhead.

For example, if the operating downlink frequency for AO-51 is listed in the satellite's operating schedule on the AMSAT Web site as 435.300 MHz, you should program

memories into your radio for 435.320 and 435.310 on the high side and 435.290 and 435.280 MHz on the low side of the published downlink frequency. Likewise, if the uplink frequency is listed as 145.920 MHz, you should program memories for 145.925 and 145.930 MHz on the high side and 145.915 and 145.910 on the low side of the published uplink frequency.

Also, like many of today's terrestrial repeaters, a number of our FM satellites require a CTCSS tone for access be sent on the uplink, so be sure and determine if the satellite you want to use requires one and set your radio accordingly. As of this writing, AO-51 required a 67 Hz CTCSS tone for access.

For a whole lot of reasons that are well beyond the scope of this article, the Doppler shift is more pronounced as the operating frequency increases. This means the Doppler shift will appear more pronounced on AO-51's downlink frequency than on its 2 M uplink. I've most often found that simply switching between my programmed 435 MHz downlink frequencies as the satellite passes overhead is usually enough to keep the satellite's downlink on frequency in my radio during the time that it is in range.

Power: How Much is Enough?

The issue of power is a relative one. It depends on the number of other people using the transponder; how much uplink gain you have in your antenna system, and how close or far away (overhead *vs.* at the horizon) the satellite is compared to your location. Usually, a 5-watt HT and the antennas shown in some of the pictures in this article are sufficient to work AO-51 on non-contentious days.

I say "non-contentious" because it is important to remember that the satellite is much like a terrestrial repeater mounted on a 500-mile high tower. With only one channel, it can get very busy, particularly on weekends. On some days, my 5-watt, dual band HT and an extended rubber duck antenna are sufficient for a quick contact on a near-overhead pass. On the other hand, during some busy weekend satellite passes, even my external Yagi and 50 watts of power isn't enough to overcome the high-powered uplinks of some inconsiderate operators.

Working in the Footprint

While it is technically possible to work these satellites at the horizon, you'll need something more than 5 watts from an HT and

a hand-held antenna to do so. It is important to remember that the footprint of the satellite, which is the area on the Earth where two stations can see these Low Earth Orbiting (LEO) satellites and work each other through them, is about the size of North America.

Some hams on the U.S. East coast have, for example, used AO-51 to make contacts into Western Europe (and from the U.S. West coast to Hawaii). But that happens *only* when one person is on the extreme edge of the footprint and their counterpart is on the other edge. [And those contacts don't last long because the mutual footprint coverage moves away very quickly! – Ed.]

Polar orbit satellites such as AO-51 will typically give you three chances to work them, twice a day. Pass duration ... the time during which you'll be in the footprint ... can range from 7-15 minutes depending on whether you are in the full footprint or just part of it during the pass.

It's interesting to note that on many passes the footprint will cover the entire Atlantic Ocean. I know of several hams who have taken their Arrow, Elk or home-brew hand-held Yagi antennas and HTs along on cruise ships and made contacts from the outside deck of their ship ... after, of course, obtaining the appropriate permission from the captain of the vessel!

Putting it All Together

Now is a good time to visit the AMSAT Web site (if you haven't already) and download a set of current online pass predictions for AO-51 from www.amsat.org/amsat-new/tools/predict. Select the satellite for the prediction (AO-51) and then enter either your Maidenhead Grid Square or your latitude and longitude into the online prediction tool. Then, click on the "predict" icon and, presto! A list of satellite pass dates and times (in UTC) and directions (in degrees) will pop up. You can also click the view the current location of AO-51 link for a snazzy map-based view of AO-51's next few orbits.

In the table, the acronym AOS stands for Acquisition of Signal which is the time when the satellite will first come over your horizon. The acronym LOS stands for Loss of Signal which is when the satellite will fall back below the horizon at your location. Both azimuth and elevation headings are expressed in the degrees of a 360-degree compass from your location.

You will also note that AO-51's satellite



The AO-51 satellite launches on a converted Russian ICBM rocket on 29 June, 2004 from the Baikonour Launch Complex in Kazakhstan. (AMSAT Photo)

passes at your location follow a repeating pattern. As the satellite is in a near polar orbit (which means it orbits over the Earth's north and south poles) this means the satellite will be in view of every spot on the planet several times each day as the Earth (and you!) slowly rotate underneath. For AO-51, and most other polar orbiting satellites, you'll usually observe a string of three passes ... one moving from north to south (or south to north) off to the east, one nearly overhead, and then one off to the west, with each pass spaced about 90 minutes apart. A similar string of passes will repeat some 12 hours later in the opposite north/south direction.

When you are first starting out, it's probably also best to pick a satellite pass that will put the satellite close to being nearly overhead (90 degrees) of your location. So, look for those pass elevations in the table that are well above 45 or 50 degrees. These will be your targets of best opportunity.

What to Listen For

Now, it's time to actually listen for the satellite. At the appointed AOS time, step outside, turn your radio(s) on and set it (or them) for one of the frequencies on the upper side of what's published for both the uplink and downlink. Then, wait for the satellite to pop above your horizon. If you are using a Yagi antenna of some sort, aim it at the horizon in the direction of the AOS prediction and start sweeping the antenna back and forth horizontally.



Be sure to turn the radio's squelch on the downlink frequency off and (carefully!) listen for the radio to quiet. Once it does ... congratulations ... you'll be listening to AO-51 in orbit some 500 miles above Earth!

You may want to practice tracking the satellite with your antenna and simply listening for the rest of that satellite pass (or a few more) to get a better idea of how the conversations flow on the bird. It is important to remember that, not only is the satellite rapidly moving toward and away from you, which is causing the observed Doppler shift in frequency, the satellite is *also* slowly tumbling in orbit. So, at multiple times during each pass, its transmit and receive antennas will be cross-polarized with yours, which, in turn, will create a significant loss in signal strength. If the satellite signal fades (or the down link gets garbled) try switching downlink frequencies on your radio up or down. Twisting or moving your antenna around to better match the satellite's changing antenna polarization with yours should also help.

During the pass, you'll probably hear one or more hams simply saying hello or exchanging their Maidenhead Grid Square numbers. Indeed, most conversations on AO-51 are usually very brief "hello – and – goodbye" exchanges similar to an HF DX exchange so as to give the many others listening in, a chance to work the bird. As you might guess, long-winded ragchews are *not* welcome on the FM birds.

It's Showtime!

When you've gathered up enough courage to actually try your hand at making a contact (and if you are using the same radio in full duplex mode on the uplink and downlink) you also need to make sure you are using a speaker separated from your microphone. This can be an earpiece or an external speaker of some kind. In full duplex mode, using a microphone and a speaker located right next to each other (such as on a handheld) will cause howls of feedback ... through the satellite! Needless to say, such activity will *also* not make you a popular camper on the bird, either!

However, once you are ready to try your luck at actually making a contact, simply wait for a pause in the action and then (quickly!) drop your call sign in between contacts. Hopefully, you will immediately hear your own signal on the downlink, a discovery that will provide immediate confirmation that you are, indeed, getting in. But, please

refrain from calling CQ because, just like causing long distance feedback and rag chewing, calling CQ on the FM birds is considered another amateur satellite protocol no-no.

But, regardless of how, where and when you do it, the first time you hear your own voice coming back down from a satellite (or someone answers your call), the thrill will be much like your very first ham radio contact, shaking hands, sweaty palms and all! It was for me.

See you on the birds!

About the Author

First licensed in 1976, Keith Baker, KB1SF/VA3KSF, holds an Extra Class license in the USA and an Advanced Class license in Canada. He is a Past President and the current Treasurer of AMSAT-North America and also served as AMSAT Executive Vice President from 1994 to 1998. Keith was also a member of the AMSAT Board of Directors from 1994 to 2003. Besides *The AMSAT Journal*, his amateur satellite-related articles and photos have appeared in *The ARRL Handbook*, *The ARRL Satellite Anthology*, *QST Magazine*, *CQ Magazine*, *CQ VHF*, *CQ Ham Radio (Japan)*, and *OSCAR News (UK)*. Keith was the author of *How to Use the Amateur Radio Satellites*, a work that was published in several editions by AMSAT-North America throughout the 1990s. He later donated that work to several other AMSAT organizations around the world where it was eventually translated into five different languages. Currently, Keith writes the quarterly "Sky Surfing" column about amateur satellites for *Monitoring Times* magazine. Some of his other more recent creative projects include writing portions of the AMSAT-NA publication "*AMSAT: The First Forty Years*," as well as serving as an editor for the ARRL's new *Satellite Handbook*. Keith currently makes his home in the small town of Corunna, Ontario, Canada with his wife, Kate (KB1OGF/VA3OGF) and daughter Emily. 📡



Getting the Right Antenna

As with any radio installation, the more money you put into it, the more versatile it will be. Still, you don't have to break the bank to get started. Here are some antenna tips to help give you a better chance for working AMSAT's so-called "EZ sats" with success.

The output power of these satellites is usually little more than a watt. Most often, the satellite's handlers will have the bird's downlink transmitters powered back into the 500 milliwatt range to help extend the life of the satellite's batteries. This means that any antenna you can muster on the ground to listen to the UHF downlinks from these satellites will help.

On the other hand, a somewhat more useful arrangement consists of a higher gain, externally mounted VHF/UHF vertical antenna such as that used for Amateur Radio repeater operation. This antenna installation will usually provide a bit more success if you want to hear satellite passes, for example, near the horizon.

Another very reliable antenna arrangement that many FM satellite enthusiasts have used consists of an externally mounted, dual-band, rotatable VHF/UHF, three or four element Yagi beam antenna set up for terrestrial operation. This approach allows users to aim their beam antenna at the horizon and work through the satellite as it rises. Then, as the satellite passes overhead, they swing their beam antenna around in the opposite direction and catch the satellite as it sets. Such an arrangement is useful for contacts on satellite passes up to about 45 degrees in elevation. Now, of course, the ultimate satellite antenna for full pass coverage is a high gain, three or four-element set of VHF/UHF Yagi beam antennas mounted on an altitude/azimuth rotator. But, you don't need that just to work the "EZ sats."

(Left) Until its successful launch, AO-51 was called "Echo" as it was the fifth satellite built entirely by AMSAT-North America. The AO-51 moniker (which denotes it as the 51st AMSAT OSCAR satellite successfully launched) was awarded once the satellite achieved orbit and transmitted from space. (AMSAT Photo)



Bringing the One True Rule of Doppler Tuning into the 21st Century

(Or, "What frequency is the DX on?!")

by Alan Biddle, WA4SCA, wa4sca@amsat.org

Abstract

In 1994, Paul Williamson, KB5MU, discussed extending the existing conventional wisdom on Doppler correction to what is known as the One True Rule. [1] This describes a method where each operator tunes his transmit frequency, corrected for Doppler, so that it arrives at the same frequency *at the spacecraft* as every other operator. Likewise, each operator tunes the receive frequency, adjusted for Doppler, to the same downlink frequency *at the spacecraft*. This optimizes the use of the linear transponder passband, and if fully automated, greatly reduces operator workload. Due to limitations in existing software, it could only be approximated at the time. Only 5 years later, software existed to support this in a basic form. Today, all the major tracking and tuning software supports this in a largely transparent fashion. It is time to review the benefits of this approach as currently implemented, and to extend this to a new, unambiguous method of specifying operating frequencies.

Introduction

One of the most significant differences between terrestrial and satellite operations is the need to track not only the satellite, but the uplink and downlink frequencies. The closest we have come to date to

"normal" terrestrial operations is a Phase 3 satellite near apogee. It appears to be nearly stationary in the sky for several hours, and once the matching uplink and downlink frequencies are found, you can tune around as you do on HF. When you tune the receive frequency a certain amount, you tune the transmit frequency an equal and opposite amount for most transponders. Some rigs such as the Yaesu FT-847 have a hardware method of locking this in. Away from this approximation of a stationary repeater in the sky, and particularly as the operating frequencies move into the microwave region, things become more complicated.

Historically, the manual method of tuning has been to adjust the highest frequency, whether the uplink or downlink. Since Doppler shift is proportional to the frequency, if you only tune one knob, this is the one. A refinement used by some is to do a quick "touchup" of the transmit frequency at the start of each station's transmission. This is simple, in principle easily understood, and is usable with old equipment. It requires no additional equipment, which can substantially simplify operations in remote locations. It has served us for decades, and is widely used to this day. However, it has major deficiencies, over and above the workload, particularly

when applied to Low Earth Orbit (LEO) and Middle Earth Orbit (MEO) satellites.

It is easy to think that the other station is doing essentially the same correction you are, with only slight differences. In the Phase 3 example above, that is essentially true. For LEO or MEO satellites, this similarity is the exception rather than the rule due to the much shorter windows and rapidly changing velocities. Each satellite pass is unique to each station except for special geometries. If the stations are very near each other geographically, then they will tune the same way. For another case, consider two stations on the same latitude but different longitudes. If a satellite in a North-South orbit passes exactly between them, then they will in fact make exactly the same tuning corrections. While possible, these are configurations rarely seen.

A much more realistic scenario would result in one station seeing the satellite pass close to overhead, and the other station seeing it much closer to the horizon. Whatever tuning method is used, these stations would make corrections at different times and amounts. For instance, the Time of Closest Approach (TCA) is the time in any pass where the rate of change in Doppler correction is most rapid, and changes from a positive to a negative correction of the receive frequency. Most importantly, the TCA (and rapid frequency change) occurs at different times for each station except for the sort of artificial situations discussed above. Figure 1 shows the difference in Doppler correction at my station and another station approximately 600 miles to the north. For the indicated period, about 2 minutes, the northern station is applying a large, negative Doppler correction while I am still applying a large positive one.

KB5MU discussed these factors in an abbreviated manner in the original article. [1] He also discussed in detail optimizing the use of traditional tuning methods. Tony Langdon, VE3JED, has an extended discussion [2] of the differences in Doppler shift, with excellent graphics, of high and low elevation passes. Both are highly recommended for those desiring more detail and a better feel for the subtle aspects of Doppler shift and correction. Since it really does depend on how you look at the

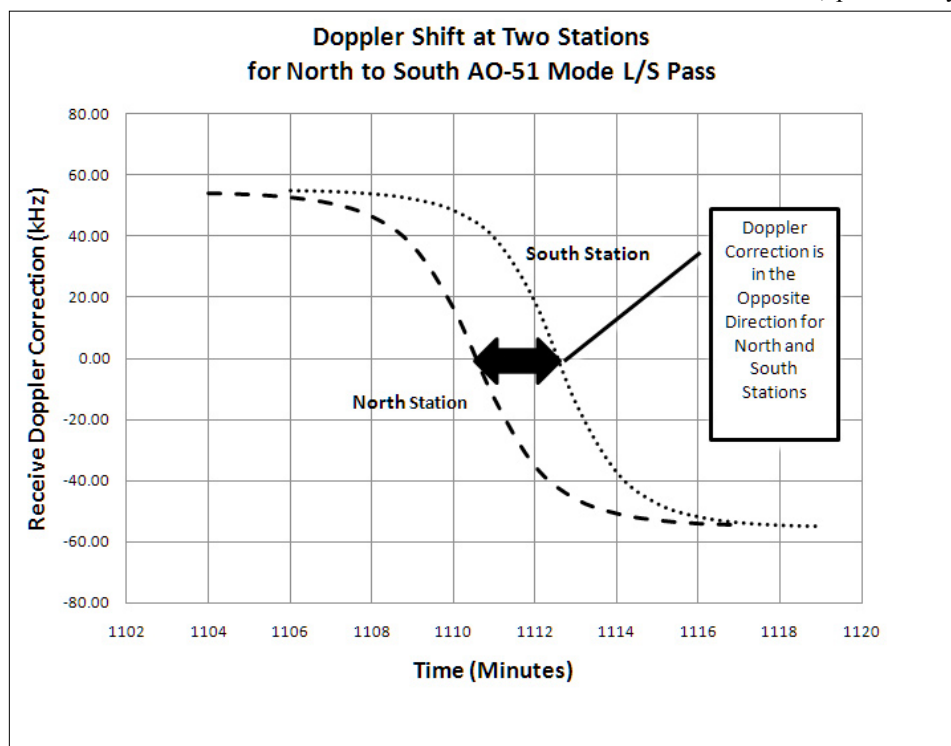


Figure 1: Doppler shift at two stations in a north to south AO-51 mode L/S pass.

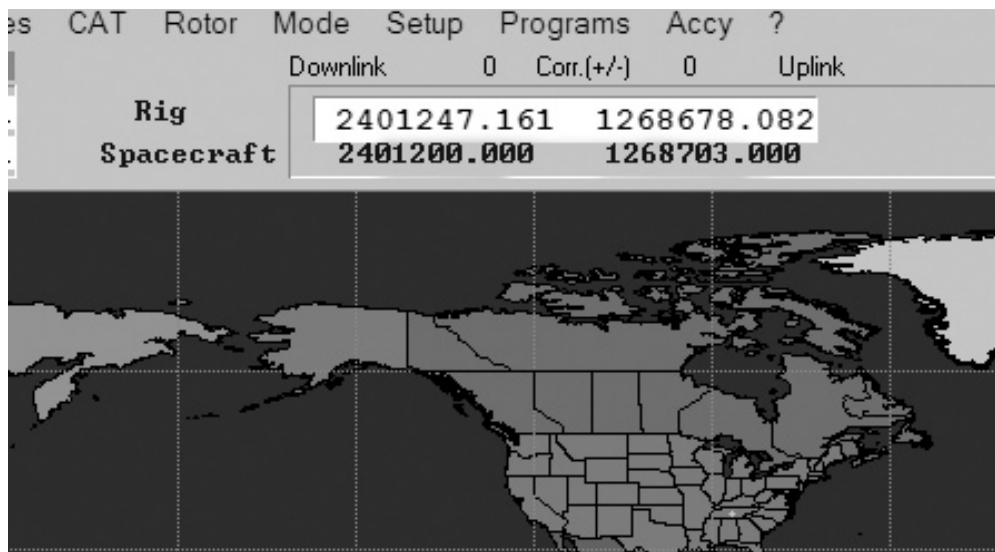


Figure 2: Mockup of program display optimized for spacecraft frequency tuning.

satellite, the brief following discussion of the limitations of traditional manual tuning is necessarily simplified. Hopefully it gives a good qualitative feel without covering all the unique ways problems can arise.

First, if we use the traditional manual tuning methods, there will be at least some drift through the satellite passband. Ideally, if everybody is using the same technique, most of the QSOs will drift roughly in parallel, most of the time. Again, around TCA, a particular station may jump in the opposite direction, or “over” an adjacent QSO. Still, as long as nobody starts near the edge of the passband, all is reasonably well. New stations just find an unused frequency pair, and go with the flow. Even this idealized situation is complicated by the fact that everybody has their own way to implement a given technique. The real world result is that you have QSOs colliding with each other in a crowded passband.

Second, you have the situation of round table QSOs. I have not quantified this, but qualitatively they seem more common today than in the AO-10 and AO-13 days. Also, there is a more natural flow of conversations, rather than a series of monologs. The result is that if you wish to tweak your uplink on each transmission, you are doing this more often. (Since most tracking programs call their implementation of the One True Rule something like Full Doppler Tuning (FDT), I will use that term for simplicity.) By comparison, I have worked multiple stations in a round table on AO-7, all using FDT, from AOS to LOS, without significant manual tuning. A recent listening survey of stations on AO-7, FO-29 and VU-52 showed about half were using FDT.

Finally, techniques which work well in

practice on modes V and U are challenging at mode L and higher frequencies, even for the relatively less critical FM modes. Table 1 shows the typical maximum Doppler shift found in selected orbits. The three altitudes shown are roughly those of AO-51 and other

Doppler shift. All stations transmitting on the same frequency will listen on the paired downlink frequency. Should another FTD station wish to use the transponder, they simply find an unused downlink frequency and call on the matching uplink frequency. The operation is very similar in concept to terrestrial repeaters, though most are FM and only accommodate a single channel.

FDT uses modern computing power and rig control to work the problem backwards, making the Doppler shift nearly invisible to the operator. The program actually “thinks” in terms of the frequencies *at the satellite* and constantly computes the matching rig frequencies. While both the uplink and downlink *on the rig* may be changing rapidly, the frequencies *at the satellite* do not. In a practical sense, the satellite appears *from an operator tuning standpoint* to be stationary.

Making this happen requires only a simple setup for each satellite transponder. You

Table 1

Maximum Doppler Shift (kHz) at Selected Altitudes for Circular Orbits				
Satellite Mode Frequency (MHz)	V 145.9	U 436.0	L 1280.0	S 2401.0
800 km	+/- 3.0	+/- 9.0	+/- 26.2	+/- 49.6
1500 km	+/- 2.9	+/- 8.6	+/- 25.0	+/- 47.3
8000 km	+/- 2.1	+/- 6.4	+/- 18.5	+/- 35.0

LEO satellites, AO-7 and a higher MEO orbit which is currently being considered. Except around TCA, even mode U Doppler shift changes slowly enough for normal human intervention. At mode S, 2.45 GHz, the shift is 5-6 times as large. More importantly, so is the rate of change. Lacking an ideal stationary satellite, the change in the Doppler shift is too rapid for all but those with the skills of a virtuoso pianist. For even MEO satellites, the uplink can drift so far from the previous frequency that the tuning required for a new transmission resembles more closely the initial hunt at the beginning of the QSO.

Using what we have

How does FDT really work? Imagine a satellite transponder on a very tall tower, or equivalently on a spacecraft in geosynchronous orbit such as the fabled Phase 4 satellite. It is stationary with respect to all stations. In this case, there is no

need to specify the relationship between the uplink and downlink frequencies. The nominal values are given for the transponder in various places including the AMSAT Weekly Satellite Report. All of the major tracking programs have this capability and explain its usage. Think of this as equivalent to “locking in” the frequency offset of a Phase 3 satellite discussed in the introduction. However, there is an important difference. Once this is done, it is good for all parts of the orbit, every orbit! [3]

Once this is achieved, you can tune around the passband. The matching uplink frequency will follow. Whatever your receive frequency, when you key the transmitter, you will hear your voice or CW come back to you. No tuning around, no “aaaaahhhhhh” dragged across a QSO in process, and better, no one doing so to you. In practice this makes satellite tuning very much like terrestrial HF. You can largely forget about what the

transmitter is doing, since the computer takes care of that for you.

Now assume someone answers who is also using FDT. You will hear the reply on the frequency you are currently listening. More importantly, over time the satellite position and hence relative velocity will change, and both station's uplinks and downlinks will be changed, but the signal will remain in tune at both stations. Should another FDT station join the QSO, all three will be able to concentrate on talking, not tuning. That is because each station will always put his uplink on the same frequency *at the satellite*, and so each station knows on a second by second basis where to look for the downlink. By contrast, the traditional methods place the uplinks scattered over a few hundred Hz to a few kHz of the satellite passband as the QSO progresses.

Is this useful with other stations still using manual tuning? Yes and no. Most programs have a way to select whether you wish to tune the uplink, downlink, or both. By selecting the one which corresponds to the higher frequency, you can decrease your workload a bit and receive most of the benefits of FDT. As a practical matter, it works better if you use either full automatic or full manual methods. People are used to using one method or the other, but not a combination. The few times I have tried a mixed mode, it generated both interest and confusion in equal parts. Of course, this is a matter of preference.

A slightly heretical technique, if you feel you must keep your hand in by tuning the receiver, is to let the computer tune the uplink, regardless of frequency. If the other operator wishes to use FDT he can, or can manually tune his receiver as well. It has the effect of keeping your uplink locked to the same frequency *at the satellite*, which is the primary QRM issue for other operators.

Another practical application is in working stations which have a very limited window of mutual visibility. The topic has come up on the AMSAT bulletin board with regard to AO-7 and other satellites with linear transponders. In a window which may be measured in a minute or less, you do not want to waste time in netting in the uplink and downlink frequencies. With FDT if you hear someone calling CQ, you already have his downlink, and your uplink will already be zeroed in for you. The only unknown is where he is listening. If he is also using FDT, you don't care! Key the rig and you

should have a QSO. What happens if he is not using FDT? He will be listening to his downlink, so at that instant he will in effect be doing FDT. Depending on how closely he matches his tuning, he will hear you exactly on frequency, or at least close enough that you will get his attention. In either case, you have your QSO.

So what is missing? FDT allows us to work a station easily which we hear while tuning around. What about a scheduled contact? A terrestrial traffic net, or a scheduled QSO with old friends, is easily specified as a frequency, +/- QRM. Everybody starts there, and then tunes around slightly. Even with FDT, we still lack a way to do the equivalent. For instance, two stations planning to meet "on 435.000 MHz" can tune their rigs to that frequency, but because Doppler shift is different for each station, they may not even be close enough to hear each other. We would like to have a frequency which each station can use in the same unambiguous way as terrestrial stations. Such a frequency exists, as we shall see, though neither the rig nor current tracking program displays it.

Where do we go from here?

With full implementation of the One True Rule, we have largely taken the busy work out of satellite communications. There is one question we have not made it easy to answer yet: "What frequency are we on?" Unless you are talking with a station across the street, each station will have his rig tuned to different receive and transmit frequencies. As we can see from Table 1, in the case of microwave frequencies, these can be significantly different frequencies. However, in the case of FDT, every station will be listening to the same frequency *at the satellite*. No matter how many are in the QSO, this will be an invariant all operators can agree upon.

This seemingly privileged frequency is not really a new idea. Modern tracking programs actually use this idea in two ways. For channelized FM satellites, you specify the repeater input and output. The program does the rest. We just say that the uplink is 145.920 MHz and the downlink is 435.300 MHz for short. The "+/- Doppler" is simply assumed, but we don't put it on a QSL card. (The classic TAPR/JAMSAT TrakBox, among other hardware implementations, also has this capability.)

The other way is when configuring the reference frequency pairs for a linear transponder. For AO-7, I find that an uplink

of 432.14768 MHz and a downlink of 145.950 MHz is a good match for the "Hello Test" calibration. The tracking program will start here, just as it would for the FM case. The difference is that as you tune around the downlink, the transmit frequency will change appropriately. While clumsy, we could specify our SSB/CW frequencies *at the satellite* here, and achieve the goal.

As we have seen, we work daily with satellite-centric frequencies, even though they are not normally visible in tracking programs. How can we make them visible? A tracking program will normally display the rig frequency, and the Doppler shift being corrected. If you add those two numbers, including the sign, the sum will not change, even though both of the components may be changing rapidly. Why? This sum is what we are looking for; the frequency *at the spacecraft*!

Assume that the authors of satellite programs make this display an option. See Figure 2 for a conceptual display. How would we use it, and how would it change our operating techniques? First we would change the way we think about and specify the QSO frequency. The full version would be "Fox, 2401.200 MHz, Spacecraft." This gives the spacecraft, and the receive frequency *at the spacecraft*. No questions or ambiguities, no matter your QTH. (This is also the frequency to which your rig would be tuned near TCA.) Do we need to specify the full mode, such as L/U or V/U? No! Both AO-13 and AO-40 had modes in which more than one uplink was translated to the same downlink simultaneously. While knowing which uplink the other operator is coming in on is interesting and appropriate for a QSL card, it is redundant so far a making a QSO is concerned. Any uplink which gives the same downlink frequency *at the spacecraft* is equivalent.

Second, the primary tuning reference would move by necessity to the computer screen rather than the rig. One could tune the rig dial, but watch the "Spacecraft Frequency" on the screen, or presumably enter it manually. With the steady progress toward software defined radios, or at least control software, this will soon seem natural, and already is for many.

Implementation

How do we get from here to there, and should we? The many existing tracking programs make this relatively easy to approximate. With your tracking software's



version of FDT engaged, one can look at the rig frequency and Doppler shift, and mentally combine them to get the needed frequency. If you have a schedule with another station using this technique, it will get you much closer than just tuning the rig to the schedule frequency, and then having to hunt around. Usually you will get close enough to hear the other station. A quick tune of your receive frequency, and you are done, except for the QSO. If this option is added into existing and future programs, it will become a true "HF mode" in terms of simplicity, both hypothetical and practical. Manual tuning, while still viable, especially for portable stations, may eventually be considered in the same way we consider Straight Key Night.

Considering that the basic One True Rule is not yet universally used 10+ years after the software to use it became readily available, it is to be expected that such a radical paradigm shift in how we specify "the frequency" will require another generation to fully assimilate and implement. Still, this extension can be tested, verified, and refined with minimal to no impact on more traditional users as operating frequencies continue to expand.

My thanks to KB5MU for valuable suggestions and insights for this article. Any mistakes and omissions are my own.

Footnotes

- [1] "The One True Rule for Doppler Tuning," Paul Williamson, KB5MU. OSCAR Satellite Report #284, Jan 1, 1994. http://www.amsat.org/amsat/features/one_true_rule.html
- [2] "A Close Up of Doppler Shift" Antony Langdon, VK3JED, <http://vkradio.com/doppler.html>
- [3] For FM operations, the nominal values are usually accurate enough. For CW and SSB, it is necessary to specify the values closer than the nearest kHz. For natural sounding reception, 25 Hz or better is desirable. This is nominally a onetime calibration, though in practice it needs to be touched up due to aging and temperature shifts in the spacecraft a few times a year. This compares well with updates for every QSO with traditional methods. ☺

AMSAT is the North American distributor of SatPC32, a tracking program designed for ham satellite applications. For Windows 95, 98, NT, ME, 2000, XP, Vista, Windows 7.

Version 12.8a is compatible with Windows 7 and features enhanced support for tuning multiple radios.

Version 12.8a features:

- Select 2D/3D map with a single mouse click
- Select Political/Physical map with a single mouse click
- AOS voice announcement
- Countdown program displays next AOS of your favorite satellites
- Automatic Internet download of Keplerian elements.
- Graphical tracking on a world map with two selectable Zoom factors.
- One-click satellite switching using 12 "letter" buttons.
- Automatic rotor control support for: LVBTracker, Kansas City Tracker/Tuner, FODtrack, Uni_Trac, SatEL, Labjack U12/U3/Piggyback, W0LMD Mini/Junior/Senior Trackers, Yaesu GS-232, ARS from EA4TX, EGIS rotors, IF-100, RIF-PC, AMSAT-DL interface, WinRotor32, HalloRotor, and WiSP DDE clients.
- Doppler tuning with on-screen frequency displays. Radio models supported:
Yaesu FT-847, FT-736R, FT-817, FT-857, FT-897
ICOM IC-820H, IC-821H, IC-910H and other ICOM radios
Kenwood TS-790 and TS-2000
DDE client programs
- "Transparent" VFO-knob tuning in addition to keyboard and mouse tuning.
- "Virtual" VFO tracking for half-duplex transceivers FT-817, FT-857, FT-897, IC-706 and IC-7000.
- Includes a special version for ISS split-frequency operation.
- Controls subaudible tone on FT-847, FT-736R, FT-817/857/897, TS790A and IC-910H.
- Includes a non-graphical version and programs that output lists to the screen, printer, or a file.
- Interfaces with WiSP, with user-defined satellite switching priority.
- Includes a separate program for tracking the Sun and Moon.

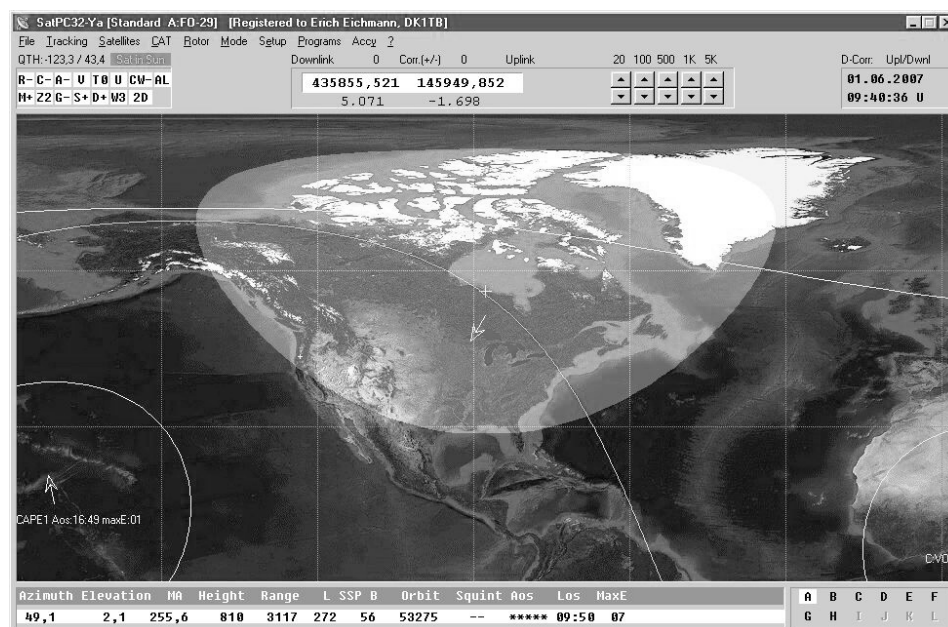
Minimum Donation is \$45 for AMSAT members, \$50 for non-members, on CD-ROM.

A demo version may be downloaded from <http://www.dk1tb.de/indexeng.htm>

A registration password for the demo version may be obtained for a minimum donation of \$40 for members and \$45 for non-members.

Order by calling 1-888-322-6728.

The author DK1TB donated SatPC32 to AMSAT. All proceeds support AMSAT.



Bits and Bytes in Space

by Pete Carr, WW3O, wb3bqo@yahoo.com

Late last year I reinstalled a packet modem at the satellite station with the idea of working the Space Station (ISS). It was a very old AEA PK232MBX unit which was driven by PakRatt® V-2.0 software that was originally written for DOS! The modem and the software worked okay on the desktop which uses the XP Pro operating system. I even got a QSL card for the packet contact with ISS.

That got me thinking about the changes in computers since the modem was first produced. Back then, the computers were of the Commodore 64 or Tandy Model One variety. Processing speed was snail-slow while available memory was extremely small. Today's computers, by contrast, are lightning quick with amazing amounts of memory. I decided to upgrade the modem and software to take advantage of this progress.

As I mentioned before, computers of that age were very low powered. For that reason a lot of the functions of the packet system were resident in the modem. For example, certain time keeping functions as well as the call sign of the unit were stored on a chip along with a memory keep-alive battery on the modem board. The architecture of the algorithms was to be largely independent

of the computer. I discovered that the entire relationship of the modem and computer has changed radically.

First, the AEA modem was built to do more than packet. It also did Morse code, Pactor and Amtor as well as several other digital modes. I wanted to focus on packet so I looked around for a new version of PakRatt software. I chose the EmComm packet software from CSS which is a download for about \$30. I tried it with the modem and got several error messages. I called CSS and they asked for the software version inside the modem and told me how to bring that up on the computer monitor. After they finished laughing at my "antique" gear they recommended that I call AEA and get new firmware for the modem. I called AEA and they also laughed before offering to sell me a new set of IC chips for about \$50. The stuff they sent was a daughterboard to be installed on top of the modem motherboard. They also sent along a new Lithium battery to keep voltage on the memory chips. The instructions were not for the board I had so I called and found that they were away at the Dayton Hamvention®. The poor fellow who got stuck answering the phones had no clue so I took a few digital pictures of the inside of the modem and e-mailed them

to him. Once he saw the board he told me just to extract the two DSP chips from the daughterboard and install them in IC-1 and IC-2 locations. Then he said to unsolder the Lithium battery and not replace it. I did all that and tested the modem in the system. It worked just fine.

Since the computer has so much speed and memory the functions that used to be handled by the modem are now in the computer. Call signs and other parameters are part of the EmComm program rather than on the modem chips. The new chips are designed to offer enhanced interface between the radio and the computer. For example, They perform digital signal processing (DSP) on the received signal to allow decoding near noise level. This reduces the need to resend data in noisy conditions.

Lee Lewis, N3NWL, operates the 147.285 repeater from a 150 foot tower northwest of Ridgway, PA. He had a spare antenna at 100 feet with a big feedline so I asked if I could mount a packet digipeater on it. He said okay so last March I installed another AEA PK232MBX modem with a 25 watt two-meter rig at his tower as a digipeater. Now I could ping the other modem from my home QTH and do tests on the software and antennas. It was amazing to compare the PakRatt software to the CSS program with the same modem. They would both work and the PakRatt was much better, but not at the level of the CSS. Those are the only two terminal programs I've tried so far.

The system is hearing packet signals from the Erie, PA area via the WW3O digipeater and also will copy APRS signals from the system at Elk County Control on 144.39 MHz. The WW3O digipeater is on 145.01 MHz. The speed of operation of either packet program is several orders of magnitude faster than in the old days. It is also easy to see the benefit of DSP on those signals of low signal amplitude.

Now that the packet system is upgraded I can begin to gather information on the data link of future spacecraft. Specifically, AMSAT-DL is planning to launch a mission to Mars. Unlike the ones now orbiting Earth that are flying repeaters, this spacecraft will perform actual information gathering work. The telemetry will include the normal housekeeping data such as temperature and battery voltage but will also do live

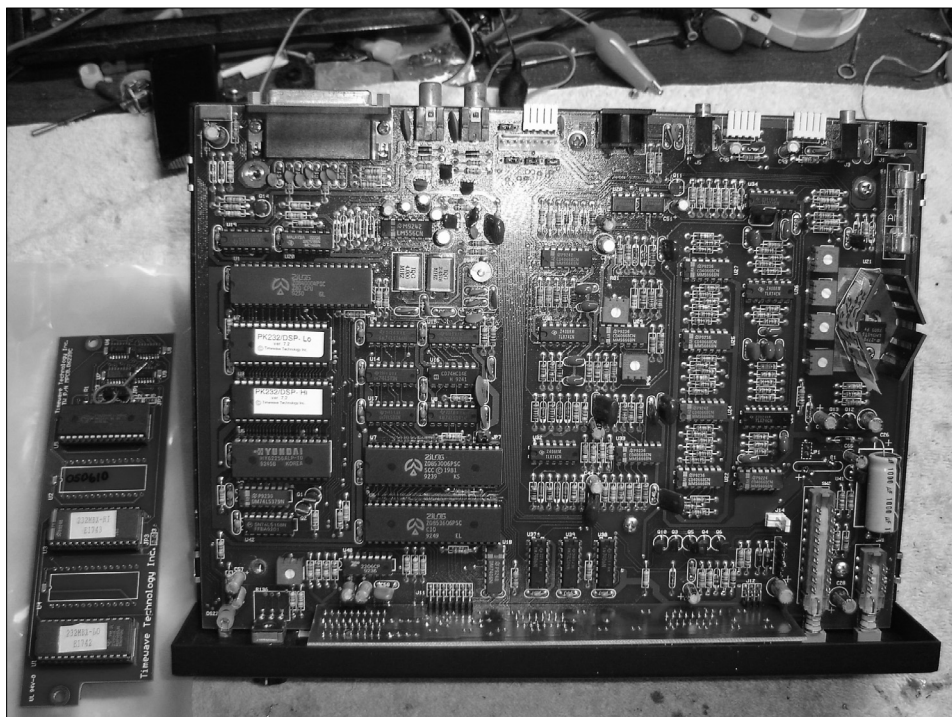


Photo 1: The two new EPROM chips have been installed in the sockets at left on the motherboard. A daughterboard is next to the motherboard and has the two original chips plugged in. I was sent the daughterboard but only needed the two chips.



television and listen for distant radio signals. This is the stuff I want to “hear” with the computer and modem.

The Moon is about 405 thousand kilometers from Earth. Hams have been bouncing signal off the Moon for years. By contrast, Mars is 55 million kilometers from Earth. It will be hard enough for the government to hear a satellite at that distance and much harder for us hams to do it in our backyards. The actual frequency of the telemetry link hasn’t been decided but it will probably be in the 70 cm band or possibly higher. Higher frequencies are generally quieter and the antennas are smaller so gain type antennas could boost the signal coming from the satellite. Once the satellite parameters are set I can start working on receive antennas and feedline. For now, I’m satisfied that the data processing part of the system is good to go. Meanwhile, I’m enjoying terrestrial packet and the occasional packet contact with ISS.

Resources:

www.cssincorp.com; Creative Software Services

www.timewave.com; PK232MBX firmware

www.amsat.org; Radio Amateur Satellite Corporation ☸



Photo 2: The modem is back in the stack on the bench. It connects to the computer via a serial cable. The Yaesu FT-290R all-mode 2 m transceiver is next to it and above the 20-amp switching power supply. The Yaesu is the RF link for FM.

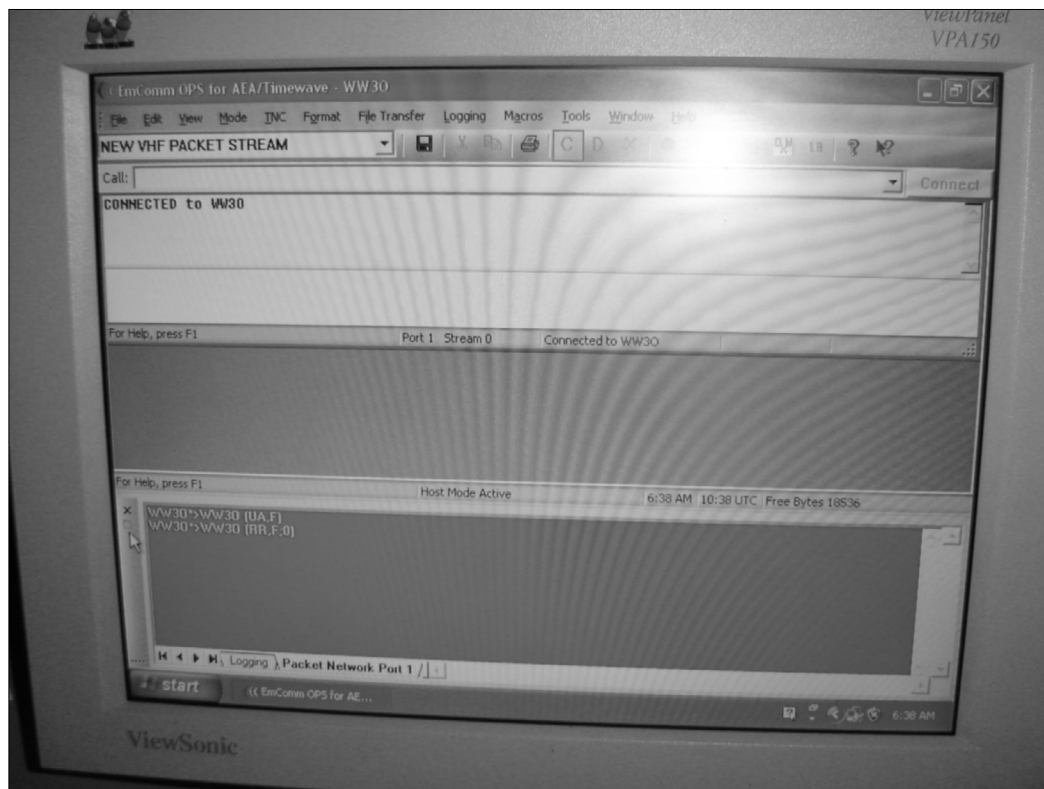


Photo 3: The computer screen shows the input and output displays of the software. It shows that the system is connected to the digipeater with the call sign WW30, which is on the N3NWL repeater tower in northwest Ridgway, PA.



Museum Ships Weekend 2010 - Special Event on the Satellites

by Allen F. Mattis, N5AFV, n5afv@amsat.org

The Brazos Valley Amateur Radio Club (BVARC) annual participation in the Museum Ships Weekend Event sponsored by the Battleship New Jersey Amateur Radio Station on June 5-6, 2010 provided an excellent opportunity to demonstrate the OSCAR satellites and Amateur Radio. During the weekend event Amateur Radio operators activated Amateur Radio stations on 83 museum ships worldwide. More than half of the museum ships were located in the United States; however, museum ships in Australia, Austria, Belgium, Canada, France, Germany, Italy, Netherlands, Norway, Spain, Sweden and the United Kingdom also participated. Amateur Radio operators who contacted any fifteen of these ships qualified for a handsome certificate.

bands—phone operation on the USS Stewart and CW operation on USS Cavalla. The radio rooms on the ships contain a considerable amount of vintage radio gear that is no longer operational but serves as a museum display. The Amateur Radio operators brought along their own equipment, but did use the long wire antennas that have been restored on both ships. A third station was set up in the park immediately adjacent to the ships and was primarily used for phone operation on the 20 M band. Operation on a regional 2 M repeater and on satellites was also conducted from the park location.

The club made a total of 495 radio contacts during the event, and 18 other ships participating in the Museum Ships Weekend event were worked. Approximately 25 Amateur Radio operators participated in the

dual-band mobile radio in a vehicle.

Two passes of SO-50 and one pass of AO-27 were worked, and a total of 26 satellite contacts were made with stations in 17 US states and Ontario. Contacts were made with K8YSE at the Hudsonville Michigan hamfest, WD9EWK at the Show Low, Arizona hamfest, and N2SPI at the Rochester, New York hamfest. It was nice to be able support these stations conducting satellite demonstrations, and to let those listening at the hamfests know that special event stations operate on the satellites. A contact with Patrick, WD9EWK, also provided the opportunity to talk with a Boy Scout about the Museum Ships Weekend Event, and the scout was able to satisfy several requirements toward the Radio merit badge. Two club stations that were demonstrating Amateur Radio to the public, W9MJL, operated by the Vermilion County Amateur Radio Association in Illinois and VE3JW at the Canada Science & Technology Museum in Ottawa, were also worked. The stations operating at the various hamfests and special events took turns working stations which allowed many contacts to be made on the congested passes.

This was the third year that BVARC participated in the Museum Ships Weekend Event, and the first two years KK5W was the only station worldwide in the event to operate on the satellites. This year we were in touch with the group at the USS Wisconsin Radio Club, N4WIS, in Virginia Beach, Virginia in advance of the event and set up a schedule for a satellite contact. N4WIS heard KK5W on the first SO-50 pass we worked but they were not able to get in to the bird to make a contact with us. KK5W and N4WIS did make contact on 20 M approximately an hour later and a scheduled contact for the next AO-27 pass was confirmed. Unfortunately we did not hear N4WIS, but during that AO-27 pass N4WIS made a satellite contact with N2SPI at the Rochester, New York hamfest. Even though we did not make a ship-to-ship satellite contact, our efforts resulted in doubling the number of Museum Ships Weekend Event stations operating on the satellites. Perhaps AMSAT members living near some of the museum ships that participate in the event will come forward and volunteer to help to put these ships on the satellites next year.



Photo 1: Allen Mattis, N5AFV, with portable satellite station on the deck of the USS Cavalla with the USS Stewart in the background (Photograph by Steve Gottlieb, WA5OEN)

During the event the Brazos Valley Amateur Radio Club (BVARC) operated club station KK5W from Seawolf Park on Pelican Island in Galveston, Texas. Seawolf Park is home to two museum ships - the destroyer escort USS Stewart (DE-238) and the submarine USS Cavalla (SS-244), nicknamed the "Lucky Lady" by submariners. As a result, a contact with KK5W counted for two ships.

BVARC operated from three locations within Seawolf Park. The radio rooms on the two ships were used for operation on the HF

Seawolf Park operation.

Out on the deck of the USS Cavalla, a portable satellite station consisting of an Icom W32A HT with an Arrow antenna mounted on a tripod was set up. This equipment caught the eye of visitors to the park and provided the opportunity to discuss Amateur Radio and OSCAR satellites with those who expressed interest. Because heavy congestion on the satellite passes was anticipated the decision was made to work the satellite passes using an Alinco DR605



As in past years, it was very enjoyable and rewarding to participate with the Brazos Valley Amateur Radio Club (BVARC) in the annual Museum Ships Weekend Event and we hope that other satellite operators will join us next year and participate in the event. 🌐

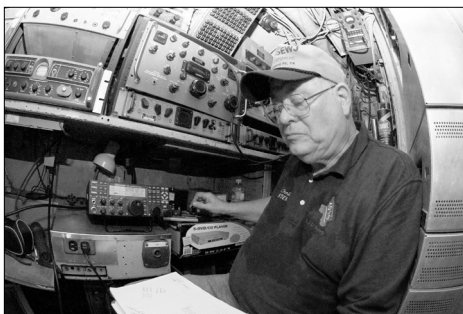


Photo 3: "Cookie" Willis Cooke, K5EWJ, working CW on the HF bands from the radio room of the USS Cavalla (Photograph by Travis Burgess)



Photo 2: "Wink" Winfred Chamberlain, N5ECE, and Joe Wileman, AA5OP, look on as Bill Stone, WS5H, tunes the across band in the USS Stewart radio room (Photograph by Travis Burgess)



Photo 4: Ross Lawler, W5HFF, and Darrell Kirk, KC5JAR, operating phone on 20 M from Seawolf Park (Photograph by Travis Burgess)



Photo 5: Travis Burgess and Allen Mattis, N5AFV, working an AO-27 pass (Photograph by Travis Burgess)



Photo 6: Mark Palsha, K14VB, and Ed Williams, KN4KL, on the USS Wisconsin operating a satellite pass during Museum Ship Weekend 2010 (Photograph by Ron Young, W8RJL)

AMSAT Field Day 2010

by Bruce Paige, KK5DO, kk5do@arrl.net

Another year, another Field Day and again more fun in the sun (or rain). We had a slight decrease in stations, but a large increase in the number of QSO's this year. VO-52 phone had the most QSO's followed by AO-7 phone and HO-68. I determine the number of satellites by mode. Thus, VO-52 in voice and CW would make two satellites. You can see from the table below that we had one satellite more this year to operate from even though we did not have the ISS operational this year.

Okay, cutting to the chase. The table at the right side of this page is what you have been waiting for. The number one station in the emergency power category is the Houston MosQRPitos, using the call W5MSQ, with a total of 77 points (4 more points than last year's winner). The Houston MosQRPitos moved up from 4th place last year.

picture of the RACES van as well as their operating positions. See the picture of the van below and the picture of the operating position on the next page. At the Udder Club, W1MOO, (also next page) we have a picture of Mike, N1JEZ, with his S-Band antenna. Mike said, "AO-51 Mode V/S portable was fun. Much easier than I anticipated using a K5GNA down converter with corner reflector hand held."

At the United Radio Amateur Club, K6AA, (next page) they had a nice AMSAT tent as evidenced by their setup shown in the photo.

Patrick, WD9EWK, operated from at the rear of his car. The station consisted of his Elk handheld 2 m/70 cm antennas. For FM he used an IC-2820H and on SSB it was two FT-817ND radios. Power was supplied with batteries which he did not recharge during

Rank	Call	QSO's	Op Type
1	W5MSQ	77	5A Emerg
2	W9LDX	70	1A Emerg
3	K4BFT	50	4A Emerg
4	N4NE	40	5A Emerg
5	WC5C	40	5F Emerg
6	K6AA	35	4A Emerg
7	XE2AT	34	1D Home
8	K8UTT	25	3A Emerg
9	W9CCU	24	5A Emerg
10	NS1RA	21	5A Emerg
11	W5IU	21	3A Emerg
12	NS3H	16	3A Emerg
13	W0MA	15	3F Emerg
14	W1BRS	15	9F Emerg
15	WD9EWK	14	1A Battery
16	VE3RC	4	2A Emerg
17	K0ND	2	2A Emerg
18	W1MOO	2	2A Emerg

	2007	2008	2009	2010
Satellites	5	8	12	13
QSO's	207	220	328	387
Stations	13	17	20	18

Holding on to second place for three years is the Lafayette DX Association, W9LDX, with 70 points.

In third place is last year's 7th place holder, the Huntsville Amateur Radio Club, using the call K4BFT with a total of 50 points.

Our top home station running on commercial power was Alvaro, XE2AT, with 34 points. Al was also one of two foreign stations submitting an entry; the other was Clare, VE3RC.

There were 13 satellites used this year with a total of 387 QSO's, up from last year's 328 QSO's. This year VO-52 carried most of the QSO's with 86 phone and 13 CW, AO-7 with 77 phone and 3 CW while FO-29 carried 60 phone and 15 CW. On the FM satellites, AO-51 carried 12 QSO's with only 3 stations reporting contacts on both modes (V/U and V/S).

At the Lockheed Martin ARC and KiloCycle Club of Fort Worth, W5IU, site we have a

the weekend.

The Tri-County Amateur Radio Club, WC5C, sent us a picture (next page) with

Bob, WD5ILB, and Bill, KF5FEI, and their Field Day site. They used full PC rotor and Doppler control which made life easier this year. Entering the wrong frequencies in the doppler.sqf messed up their first VO-52 pass.

Next year, as I have said many years before, I hope that we have even more participants in the AMSAT Field Day. Hopefully, Murphy will not visit your Field Day site. But if he does, be prepared.

73 and Good DX,

Bruce, KK5DO ☸



The W5IU van.

Field Day photos continue on the next page ...





W5IU operating position.



K6AA tent. [Love those pink flamingos! Quite classy! - Ed.]



N1JEZ with a corner reflector and a K5GNA downconverter for S-band.



WD9EWK's operating location (above) and radios (below).



WC5C operators Bob, WD5ILB, and Bill, KF5FEI, at their operating position. Note the posters describing their operation and the speakers at the bottom to allow visitors to hear what is going on. Nice setup! They draw a crowd too! (right)



K7FDF Field Day Operations by Bob Johnson, W7LRD, w7lrd@amsat.org

K7FDF is operated by a group of local volunteer hams who serve as back up communications for the city of Renton, WA should an event (earthquake, storms, etc.) overwhelm local communications systems. We are well structured and supported by the city of Renton. We have regular meetings and drills. This is the first time we have ventured into a Field Day event.

I am the Washington state area coordinator for AMSAT and also a member of the K7FDF group. Since this was our first Field Day effort we were on the steep part of the learning curve. It was an “enlightening” process and it was fun. The food wasn’t too bad either. Our score was not competitive; however the learning process was significant.

We operated HF and my jury-rigged satellite antenna system worked super. I used a UEK downconverter, to a 5-turn LHCP helix feed in front of an 18 inch DirecTV type dish. Uplink was an Arrow antenna with the duplexer bypassed. The radio was my IC-910H. The AZ/EL system was operated by hand without too much yelling. The directivity of the 18” dish can be a bit sharp.

We received a bit of local publicity and interest especially due to those weird looking satellite antennas.

73,

Bob, W7LRD 🌐



The K7FDF Field Day operation.



DirecTV antenna with the downconverter and helix feed.



Slightly different view of the K7FDF setup.

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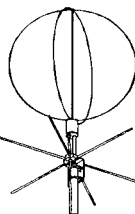
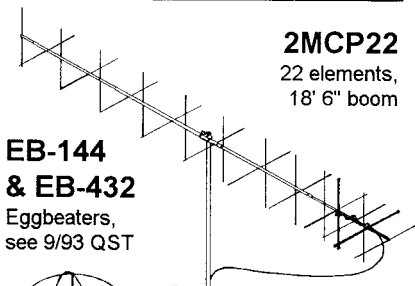
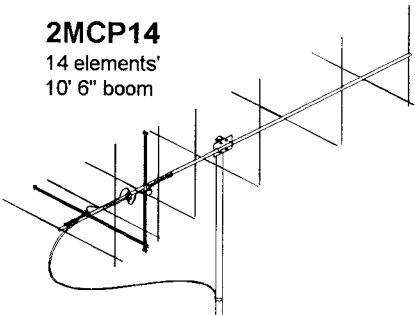
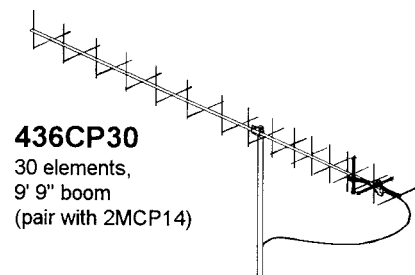
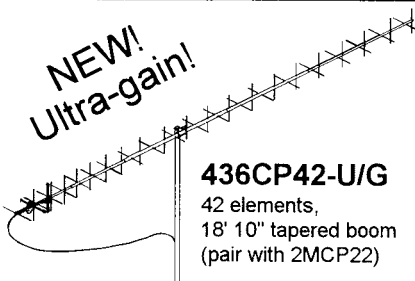
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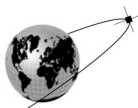
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Apogee View - continued from page 3 ...

required integration work in Moscow prior to shipment of the satellite to the Baikonur Cosmodrome in Kazakhstan for placement on Progress 41P. At this point in time, we are basing our project work on that delivery date.

We are nearing the finish line regarding ARISSat-1. Over the course of the summer, the ARISSat-1 Team, including Gould Smith, WA4SXM, and Lou McFadin, W5DID, along with Tony Monteiro, AA2TX, Jerry Zdenek, N9YTK, and Bob Davis, KF4KSS, have put forward many hours of sweat equity finishing and testing the entire spacecraft and the associated electronics as well as developing documentation for the PSRP. In addition, the team in Orlando has spent many hours dealing with final assembly of the spacecraft, including the proper torque and securing of several hundred screws per space frame. AMSAT is building two spacecraft for shipment to RSC-Energia plus completing two more for placement in storage in the US for future flight opportunities.

AMSAT-UK Colloquium

One of the highlights of this summer for me was the opportunity to attend this year's AMSAT-UK Colloquium in Guildford, England that took place over the weekend of July 30 to August 1. This was my first opportunity to attend the Colloquium and I had a great time attending the presentations, meeting some outstanding amateurs, and participating in the Colloquium's social activities. I even purchased from the AMSAT-UK Store (set up in an adjoining conference room) a 70 cm parasitic Lindenblad antenna kit based on a design by Tony Monteiro, AA2TX, with the parts kit developed by John Heath, G7HIA. It was a pleasant surprise to find this kit as I was already impressed by Tony's design and a kit makes it that much easier to put one together. You may recall that Tony wrote a series of articles on his 2 meter and 70 cm Lindenblad antennas in *The AMSAT Journal* as well as *QST*. One difference is that the kit supplies parts measured in metric while Tony's articles provided measurements in English units.

The primary purpose for my attendance at Colloquium was to make a presentation to our European friends concerning current activities of AMSAT. I first discussed our experiences with dealing with ITAR (International Traffic in Arms Regulations)

and the environment in which we find ourselves concerning our participation in international projects. From the feedback that I received after my presentation, my impression is that many of the attending amateurs were not aware of the regulatory constraints that US nationals now face regarding technical discussions on topics subject to ITAR. A number of participants expressed appreciation for the information that I provided as well as puzzlement about the unintended consequences of ITAR.

During my presentation I also covered ARISSat-1, including a technical overview as well as highlighted the importance of this project to AMSAT. As I've noted previously, ARISSat-1 is of critical importance to AMSAT as a test bed for new technology, a platform for flying student experiments in space (thus providing the potential for recurring Amateur Radio payloads deployed in low earth orbit), and serving as a conduit for continued support of Amateur Radio in space by the space agencies (RSC-Energia and NASA).

If you're interested in seeing any of the presentations that were given at Colloquium, you can review the video of each presentation. Go to <http://www.batc.tv/> and select "film archive". From there, you may select each presentation for download or viewing online.

If you have the opportunity to attend an AMSAT-UK Colloquium, I encourage you to do so. A colloquium in the UK is similar to our symposium in the U.S. with regard to the subject matter presented and the nature of the talks. One significant difference is that that British Amateur Television Society (BATS) provided a live online video feed of the presentations and a number of individuals took full advantage of this opportunity. At one point, I understand that there were over 70 connections made at one time of people receiving video of live presentations. As noted earlier, there is an archive of video recorded during Colloquium as well as a video that provides some background on how the video was produced and put on the Web.

Congratulations to AMSAT-UK for a very successful Colloquium and many thanks for the gracious welcome and hospitality extended to me by the AMSAT-UK leadership, including Graham Shirville, G3VZV, and Jim Heck, G3WGM. Jim serves as Honorable Secretary of AMSAT-UK and Graham is an AMSAT-UK committee

member. Graham is also serving as Project Manager for AMSAT-UK's FUNCube project as well. Peter Guelzow, DB2OS, President of AMSAT-DL made a presentation at the Colloquium on the status of Phase 3-E and their efforts to secure funding from the German Space Agency for both P3-E and P-5A. Peter hopes to learn by the end of 2010 whether they will receive funding to complete these projects. Peter's presentation is also available on BATC Web site which provides an excellent overview of AMSAT-DL activities during the past year and the status of P3-E

Project Fox

As I'm writing this article, it now appears that there is a good chance that development work for Project Fox will involve students at SUNY-Binghamton. At this point, however, it is not yet clear the degree of student involvement or what specific areas will incorporate student participation. Their participation will be defined later this month. The potential for student involvement is a significant opportunity for both AMSAT and SUNY-Binghamton as students see their work fly in space as well as provide AMSAT with a cadre of personnel focused on making Fox a reality. Further, this helps AMSAT fulfill our goal of expanded educational outreach. I expect that more details on Project Fox and SUNY-Binghamton participation will be presented at the upcoming Symposium.

AMSAT Symposium

Please remember that the upcoming AMSAT Symposium will be held the weekend of October 8, 2010 at the Holiday Inn in Elk Grove, IL. You may register for the Symposium at the AMSAT Web store as well as get more details on the Symposium itself. See: <http://www.amsat.org/amsat-new/symposium/2010/index.php>

If you have never attended a Symposium previously, please consider attending this year's meeting and take full advantage of the presentations and social activities that will occur that weekend. The Saturday evening banquet will feature Dr. Albert Stebbins of NASA/Fermi National Accelerator Laboratory as our speaker. There is also a tour of Fermi Lab scheduled for Sunday afternoon as well. Full details on the schedule of activities can be found at the Symposium Web page. See ya in Chicago!

Barry Baines, WD4ASW

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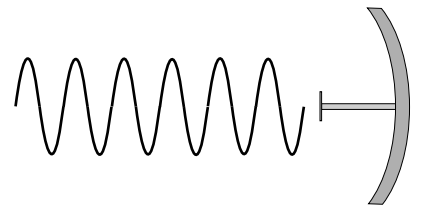
THANK YOU!



Ham Gets a Close-up Shuttle Launch View

Bobby Lacey, KF4GTA, was chosen to participate in NASA's STS-132 Tweetup for Shuttle Atlantis' final scheduled launch on May 14. Some of the highlights Bobby participated in included viewing the RSS retract on Thursday evening. Bobby watched and photographed the launch from the press site about 3 miles from the launch pad on Friday.

Bobby has posted a video of the launch at: <http://bit.ly/cPnA6o>



Bobby, KF4GTA, waits in front of Launch Complex 39-A with Atlantis in the background.



The view at Launch Complex 39A following RSS Retraction.



Atlantis liftoff as viewed from the press area.

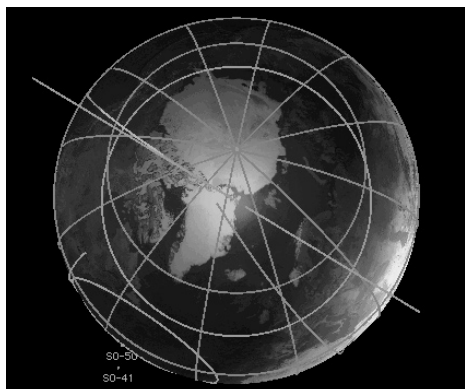
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- Video recording, digital conversion and editing
- Write technical or instructional material
- Educational activities
- Promoting AMSAT as an Area Coordinator



and any other area you think you think you can make a difference.

We often have people volunteer, but many don't deliver on their promises. So, pick an area that you think needs improvement and explain what you will do to make it better. Then do something to show that you can follow through.

Send your suggestions, actions plans and a description of why you are capable of doing this task to Gould Smith, WA4SXM, wa4sxm@amsat.org



Activating Curacao

by John Shew, PJ2/N4QQ, jshew2@verizon.net

At Dayton this May I was invited to operate in the CQ WPX CW contest over the Memorial Day weekend at the Curacao station, PJ2T, with fellow AMSAT life member Jim Fitzpatrick, WI9WI. Since I won an Arrow antenna at a recent AMSAT annual meeting a couple years back and the AMSAT dual-band, hand-held Kenwood THD7 was available for loan, I decided to give the LEO's a try from Curacao on this trip. The THD7, preprogrammed by KO4MA for the common LEOs, arrived at my house by FedEx three days before my flight and I was able to check out the equipment on a total of two LEO passes before my departure.

While in Curacao I worked several AO-27, HO-68 and AO-51 passes on the days immediately before and after the WPX contest. The first contact from PJ2/N4QQ was with KD8KSN on AO-27 on Thursday, May 27th. The last contact was with KD8CAO on AO-51 on Tuesday June 1st. In between a total of 30 different stations were worked in 5 countries. Since this was my first effort working LEOs, I was quite pleased how well everything worked, although there were a few rough spots. My most pressing problem was keeping an accurate log since I didn't have a free hand to write with during the actual pass. WI9WI was able to help record the calls during the passes after the

contest, but before the contest I was on my own, as Jim was focused on preparing the HF station for the WPX test.

I did come up with a partial solution to the logging problem using PJ2T's DSL connection to the Internet. A few minutes after each pass, I would link to K8YSE's Web site (www.papays.com) and about half the time there would be a recording of the pass posted. In many cases I was able to fill in the calls that I missed logging 15 minutes earlier. K8YSE's recordings allowed me to hear what my signal sounded like on the other end.

A second recurring problem was my inability to capture the satellite passband when the satellite was heavily loaded or at low elevations. This was a particular problem on AO-51, less of a problem on AO-27 and HO-68 which were usually lighted loaded. I will be returning to Curacao for future contests and plan further LEO operations, hopefully with an additional 6 db of uplink for the marginal passes.

Finally, I would like; to thank the extended AMSAT team who build, maintain, publicize and document the various amateur satellites; to thank the users who make operating the satellites so much fun and; to thank my wife, Martha, [of AMSAT fame! - Ed.] who lets me go the Curacao a couple of times each year to play radio. 📡



PJ2/N4QQ manning the radio and antenna.

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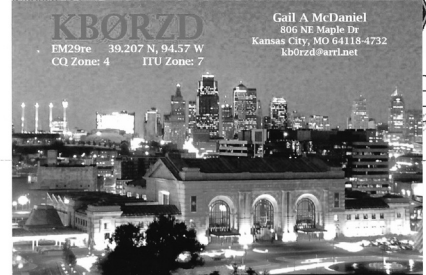

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QSL's from the trip!

The One That Didn't Get Away by George Jounakos, K2KVI, k2kvi@arri.net

When you speak with someone about fishing, you usually get the story about 'The one that got away'. After Field Day this year it seemed like that's all Pete, WB2OQQ, and I had to talk about, 'The one that got away'. As a result of the many FD antennas, some directly over us, it was a challenge for us to make contacts - lessons learned for next time.



Pete, WB2OQQ, carries a mock up of AO-7 to the demonstration.

Next time in this case was our Special Event at Custer Institute on July 10, 2010. We planned on making the most of it. Armed with multiple antennas and a Yaesu AZ-EL rotator, we weren't going to let that, in this case, 'bird' get away this time.

After set-up, we checked everything out and made a few contacts, first using the manual tripod and then using the rotator. All seemed to be working great.

Pete gave a talk on satellite communications. We had one more opportunity to give a demonstration to the observatory staff and visitors. We told them the next pass was going to be at 5:45 PM.

There was no turning back now. Pete and I started getting ready for the pass and noticed a large group of people heading our way. I'm not sure if we were thinking "Great we can show them how this works." or "I hope this works.". A minute or two into the pass all we heard was the AO-51 beacon and noise, which made no sense. I kept asking Pete if he was on the correct frequency as I tried to aim the rotator to where AO-51 should be. The laptop with the tracking program was stowed away, so I was flying blind, only knowing the starting azimuth of the pass.



Pete works feverishly to get the radios working.

Just as we both starting thinking "I guess this one got away", Pete tuned up-frequency and I caught a faint signal in the noise. Pete tuned it in while I tried to get a fix on it; while Pete was using his Doppler pre-sets in the radio to "tune in" the satellite.

Once we found it, we made several contacts and as AO-51 dropped closer to the horizon we figured we were done. But wait, we were still tracking it and had strong signal. This is now at about 10 degrees elevation. So Pete kept working it and making contacts. Now the rotator was at 0 degrees and we still heard Pete on the downlink.

I guess this was a good example of what atmospheric conditions can do to signal propagation. It also shows, don't give up. (Especially when a large group is watching!)

All good must come to an end and we did finally lose contact with AO-51. However, this one didn't get away and made up for the lack of contacts on Field Day. Next stop: Fire Island, August 21-22. I wonder what else we can add to our tool bag? ☺



Mission accomplished! The demo is finally underway.

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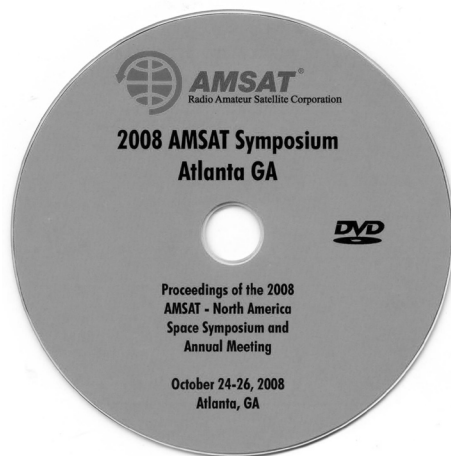
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Book 'Em Danno! *Hawaii Five-0*TM Adrian Engele, AA5UK, aa5uk@yahoo.com

After last year's successful trip to the Cayman Islands, my girlfriend Ellen and I had to make our annual decision: "where do we go this year?" After looking at several locations, we decided on Oahu and Kauai. I wrote to several active satellite operators and everyone agreed someone needs to activate Hawaii, especially for those operators East of the Mississippi needing KH6 for their WAS Satellite. Once I put out some initial feelers on the AMSAT BB, I received a flurry of e-mails from many operators. Tim, N3TL, was one of the first to ask for a sked since Hawaii was his last needed state. I also made some initial contacts with some of the local Hawaiian satellite operators: Kyle, WH6BIE, Tad, NH7YS and Robert, NH7WN, to get some pointers and a feel for the local operating conditions. One thing that quickly became apparent, there were plenty of FM contacts with the western most states but few contacts on the SSB satellites. Kyle has a setup to work the linear satellites, but he is limited due to trees at this home. Robert and Tad pretty much work the FM satellites with limited footprints.

Prior to the trip, I contacted Alan Kung, BA1DU, from the HO-68 command team. I mentioned to him my KH6 DXpedition plans and he agreed to include my operation into the schedule, since the satellite was not

always activated over Hawaii. This worked out perfectly as it allowed me to fine tune the planning schedule for HO-68 both on FM and SSB. A big thank you to Alan! Also Patrick, WD9EWK, posted my trip on one of the XE satellite blogs which immediately generated e-mails from Alvaro, XE2AT, Omar, XE1AO, Bernardo, XE2HWP, and several others requesting a contact from KH6. I also had a nice e-mail from Masahiro Arai, JN1GHZ, from Japan, asking me to make an effort to work JA's on FO-29. I looked into the schedule and found it would be possible but somewhat difficult from the Kauai QTH. I later found out Masa is the *Japan CQ* ham satellite column editor. Many other e-mails poured in for sked requests.

I decided on this year's equipment: FT857D (for TX), and FT817N (for RX) running CAT control via my Acer One netbook running SatPC. My antenna was upgraded to an ELK Log Periodic using the same photo tripod I used the year before. Prior to the trip, I managed to get all the settings properly adjusted on SatPC so everything would be ready to go once I landed on the islands.

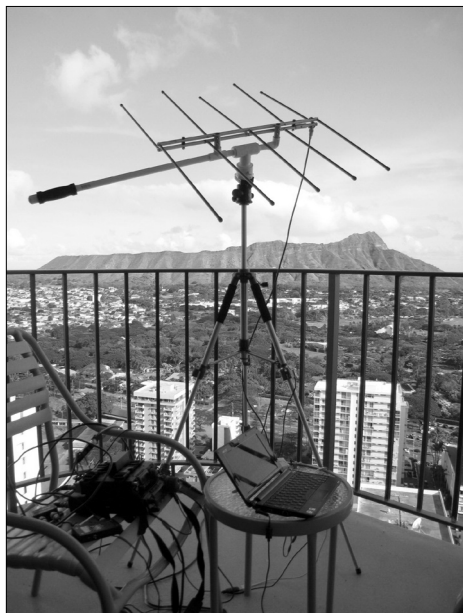
We left from Chicago O'Hare on March 24th, 2010 and flew directly to Oahu where we stayed on Waikiki beach for several days, first at the Marriott Waikiki. Without even asking we were put on the highest floor facing east. It was the perfect location, so I thought. Although I did have a great view overlooking Diamond Head, I found some of the more critical passes would be blocked by some of the mountains to the North. Ellen and I did the typical "touristy" things in town for the first few days. She being a big *Hawaii Five-0* fan wanted to see some of the sites made famous by the TV show, something we both enjoyed doing. One day we decided to drive around the island. That afternoon of the 26th, we pulled over by a beautiful beach and I checked the satellite passes on my newly installed HamSatDroid program on my Android phone. I saw HO-68 was coming up pretty quick and I knew it was in FM mode. I only had my HT and a magnet mount antenna with me at the time. I barely managed to work my first contact from KH6: Kerry, WC7V, before I lost the satellite behind some palm trees.

One afternoon, back at the hotel, I fired up the radios to check out AO-51. Kyle, WH6BIE, popped up to say "Aloha" and then Robert,

NH7WN, also showed up. We wound up having a fun impromptu roundtable and had the satellite all to ourselves for the next 15 minutes. This was one of my memorable contacts.



Adrian, AA5UK, on his Hawaiian trip.



Balcony at the hotel on Waikiki Beach looking at Diamond Head with the antenna, radios and PC set up. [Is this a nice QTH or what?!?! -Ed.]

On March 27th, we flew over to Kauai and settled into our rental home about 1.5 miles inland from Kapaa in grid BL02ic. Over the coming days, we explored the island, managed to get a few dives in and generally just had fun and relaxed. One of the things, we were not counting on and which would significantly impact the DXpedition was the weather. Over the nine days that we stayed on Kauai, we had mixed weather for seven days. By mixed, I mean heavy downpours and winds 25 to 30 mph, gusting at times to 40 mph. Not something you want when your portable gear is setup on the lanai (balcony). It often meant pulling the plug in the middle of a QSO and covering the cocktail table (my radio shack) and the radios with towels. One interesting phenomenon that I have never experienced before: static due to salt spray. Over the next several days, I could see a quarter mile high salt fog off in the distance, getting kicked up by the strong daily winds off the beach. Since most of my passes would be at low elevation pointing directly into these fog clouds, it quickly became apparent many passes would be problematic. I often had S5 to S9 noise on both VHF and UHF bands which made it very difficult to





Waikiki Beach.



Adrian at a lighthouse on Kauai.

hear the weak satellites like AO-7, and made working FO-29 and VU-52 challenging. Once the winds died down and the salt fog lifted the static magically disappeared!

I worked as many passes as my free time permitted early mornings, afternoons and evenings. My concentration was to primarily work the SSB satellites. I quickly found out how few operators were on the satellites. In fact, I often had the satellite all to myself for an entire pass with no takers. On two separate passes John, W6ZKH, and Hans, NH6VB, popped up to say hello as they felt sorry no other stations were on wanting to work me. Very strange considering the many e-mails I had received prior to my trip from operators wanting to work me. About two thirds of the passes were contactless even with deep passes into CONUS.

One of the most extensively planned skeds was for a contact with Tim, N3TL, in EM84. We were going to try for a March 31st pass on AO-7 using CW. Since my CW is so rusty and the pass would be very short, about 2 minutes, with only a few degrees of elevation, it was decided we would both program our radios with CW macros. Since we both knew ahead of time what was being sent, it would be a quick and easy contact. That morning the weather was very unfavorable, the QRN was high. AO-7, in Mode B, rose over the Pacific horizon and I looked for Tim. I heard nothing but static and noise. I sent my macro but to no avail - I could not hear Tim. After two minutes I gave up, I started to hear several calls and tried to respond, but again the signals were fading badly. I only managed to work Kerry, WC7V, on that pass. I am convinced too many operators were on during that pass quickly taxing the Old Lady AO-7 to the stretching point. Several days later, Tim sent me an excited e-mail saying there was a FO-29 pass at 03:31Z on April 3rd. I checked my printout, no luck. So I reran the numbers and saw a pass was indeed possible. Weather conditions were much better and the static was gone. Again I waited for the satellite to rise up from the Pacific horizon. I heard a very faint CW call signing N3TL. I sent my macro and we managed to put the contact in our logs. Tiny Locator had the distance at 7,399K km/4,621 miles! Not bad considering we were both working the exact same gear as portable stations!

On April 1st during the 07:05Z pass, I worked Kosyrev, UA0CQ, (PN78ml), Tetsurou, JA0CAW, (PM97nw) and Hashimoto,

JA8FY, (QN03fy). This was a 13 degree max elevation pass on FO-29 through some high mountains and bushes. I tried several additional passes on FO-29 over the coming days to work more JA's, but the passes were often blocked or the passes were too early as the local operators were still at work. I also had great fun working Alvaro, XE2AT, who has been chasing BL02 for over ten years, Omar, XE1AO, (BL02 was a new grid for him) and Bernardo, XE2HWP. All three were outstanding operators and a joy to work. Just as Kerry, WC7V, was my first contact, he wound up being my last contact on April 5th on AO-51 at 02:13Z.

After returning home, I spent a few hours one weekend transcribing the log from the recorders and my notebook notes. In the end, I worked fifty passes making fifty contacts with twenty six grids, ten states and four DX countries. I was initially disappointed by the slim log since the pre-trip e-mails indicated a very busy operation. In the end, Alex, KC7MG, made his first KH6 contact. Several JA's, one UA and several XE stations all managed to get BL02 in their logs. I also came to the satisfying realization that thanks to this DXpedition a long journey came to an end for several operators: Tim, N3TL, Dave, KN4OK, George, WA5KBH, Damon, WA4HFN and Rick, WA4NVM. These operators all logged their 50th and final state as part of their journey to achieving WAS satellite. Congratulations on a fine achievement for getting their "Hawaii Five-0TM".



The shack at Kauai.



Pacific ocean view on Oahu.

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